What is claimed is:

1. A system for electronically actuating valves in an internal combustion engine, comprising:

a first voltage source;

a second voltage source; and

plural valve actuator subsystems coupled between the first voltage source and the second voltage source, each valve actuator subsystem having a valve actuator and a switch,

where the switch and the valve actuator of one of the valve actuator subsystems are configured so that current flows from the first voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the second voltage source,

and where the switch and the valve actuator of another of the valve actuator subsystems are configured so that current flows from the second voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the first voltage source.

2. The system of claim 1, where the second voltage source includes a capacitor, the capacitor being selected to charge to a voltage higher than a voltage of the first voltage source.

3. The system of claim 2, where for said one of the valve actuator subsystems, the valve actuator and switch are coupled in series between the first voltage source and a ground voltage, and where for said another of the valve actuation subsystems, the valve actuator and switch are coupled in series between the second voltage source and the first voltage source.

4. The system of claim 1, where for each valve actuator subsystem, the valve actuator subsystem further includes a freewheel diode configured to permit freewheel current to circulate from the valve actuator to one of the first voltage source and the second voltage source upon opening of the switch.

5. The system of claim 4, where for each valve actuator subsystem, the switch and the freewheel diode provide alternate pathways for current flowing through the valve actuator, the alternate pathways being selected based on whether the switch is opened or closed.

6. The system of claim 1, where for said one of the valve actuator subsystems, the valve actuator and switch are coupled in series between the first voltage source and a ground voltage, and where for said another of the valve actuation subsystems, the valve actuator and switch are coupled in series between the second voltage source and the first voltage source.

7. The system of claim 1, further comprising:

a third voltage source; and

plural valve actuation subsystems coupled between the second voltage source and the third voltage source, each including a valve actuator and a switch,

where the switch and the valve actuator of one of the valve actuator subsystems coupled between the second voltage source and the third voltage source are configured so that current flows from the second voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the third voltage source,

and where the switch and the valve actuator of another of the valve actuator subsystems coupled between the second voltage source and the third voltage source are configured so that current flows from the third voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the second voltage source.

8. The system of claim 7, where the second and third voltage sources are energy storage devices including capacitors, the system being adapted so that during operation, the third voltage source is at a higher voltage than the second voltage source, which is at a higher voltage than the first voltage source.

9. An internal combustion engine, comprising:

a plurality of cylinders, each having one or more valves that are selectively openable and closable; and

a system for electronically actuating the valves, the system including:

a first voltage source;

a second voltage source; and

plural valve actuator subsystems coupled between the first voltage source and the second voltage source, each valve actuator subsystem having a valve actuator and a switch,

where the switch and the valve actuator of one of the valve actuator subsystems are configured so that current flows from the first voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the second voltage source,

and where the switch and the valve actuator of another of the valve actuator subsystems are configured so that current flows from the second voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the first voltage source.

10. The engine of claim 9, where the second voltage source includes a capacitor, the capacitor being selected to charge to a voltage higher than a voltage of the first voltage source.

11. The engine of claim 10, where for said one of the valve actuator subsystems, the valve actuator and switch are coupled in series between the first voltage source and a ground voltage, and where for said another of the valve actuation subsystems, the valve actuator and switch are coupled in series between the second voltage source and the first voltage source.

12. The engine of claim 9, where for each valve actuator subsystem, the valve actuator subsystem further includes a freewheel diode configured to permit freewheel current to circulate from the valve actuator to one of the first voltage source and the second voltage source upon opening of the switch.

13. The engine of claim 12, where for each valve actuator subsystem, the switch and the freewheel diode provide alternate pathways for current flowing through the valve actuator, the alternate pathways being selected based on whether the switch is opened or closed.

14. The engine of claim 9, where for said one of the valve actuator subsystems, the valve actuator and switch are coupled in series between the first voltage source and a ground voltage, and where for said another of the valve actuation subsystems, the valve actuator and switch are coupled in series between the second voltage source and the first voltage source.

15. The engine of claim 9, further comprising:

a third voltage source; and

plural valve actuation subsystems coupled between the second voltage source and the third voltage source, each including a valve actuator and a switch,

where the switch and the valve actuator of one of the valve actuator subsystems coupled between the second voltage source and the third voltage source are configured so that current flows from the second voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the third voltage source,

and where the switch and the valve actuator of another of the valve actuator subsystems coupled between the second voltage source and the third voltage source are configured so that current flows from the third voltage source through the valve actuator when the switch is in a first position, and when the switch is in a second position, current is permitted to flow from the valve actuator toward the second voltage source.

16. The engine of claim 15, where the second and third voltage sources are energy storage devices including capacitors, the system being adapted so that during operation, the third voltage source is at a higher voltage than the second voltage source, which is at a higher voltage than the first voltage source.

17. A system for electronically actuating valves in an internal combustion engine, comprising:

a power supply;

an energy storage device; and

plural valve actuator subsystems coupled to the power supply and energy storage device, each valve actuator subsystem having a valve actuator, a switch coupled within a charging current pathway, and a freewheel current pathway,

where at least one of the valve actuator subsystems is arranged in a boost configuration, in which current generated by the valve actuator in response to voltage applied from the power supply is conducted through the freewheel current pathway to the energy storage device when the switch is in a first position,

and where another of the subsystems is arranged in a buck configuration, in which current generated by the valve actuator in response to voltage applied from the energy storage device is conducted through the freewheel current pathway back to the power supply when the switch is in a first position.

18. The system of claim 17, where the energy storage device includes a capacitor adapted to charge to an operating voltage, which is higher than a voltage of the power supply.

19. The system of claim 18, where for each valve actuator subsystem arranged in a boost configuration, the valve actuator and the switch are coupled in series between the power supply and a ground voltage, and where for each valve actuator subsystem arranged in a buck configuration, the valve actuator and the switch are coupled in series between the energy storage device and the power supply.

20. The system of claim 18, where for each valve actuator subsystem arranged in a boost configuration, the valve actuator and the switch are coupled in series between the power supply and a ground voltage, and the valve actuator and a freewheel diode are coupled in series between the power supply and the energy storage device.

21. The system of claim 18, where for each valve actuator subsystem arranged in a buck configuration, the valve actuator and the switch are coupled in series between the energy storage device and the power supply, and the valve actuator and a freewheel diode are coupled in series between the power supply and a ground voltage.

22. The system of claim 18, where for each valve actuator subsystem arranged in a boost configuration, the valve actuator and the switch are coupled in series between the power supply and a ground voltage, and the valve actuator and a freewheel diode are coupled in series between the power supply and the energy storage device, and where for each valve actuator subsystem arranged in a buck configuration, the valve actuator and the switch are coupled in series between the energy storage device and the power supply, and the valve actuator and a freewheel diode are coupled in series between the power supply and the ground voltage.

23. A system for electronically actuating cylinder valves in an internal combustion engine, comprising:

a power supply;

an energy storage device; and

plural valve actuator subsystems coupled to the power supply and the energy storage device, where each valve actuator subsystem includes:

an actuator;

a freewheel diode; and

a switch coupled with the actuator and freewheel diode and configured so that, when the actuator is energized via voltage applied from one of the power supply and the energy storage device, an open or closed state of the switch determines whether actuator current flows through the actuator and the switch, or through the actuator and the freewheel diode.

24. The system of claim 23, where the energy storage device includes a capacitor.

25. The system of claim 23, where at least one of the valve actuator subsystems is configured in a boost configuration, in which the actuator is energized via voltage applied from the power supply when the switch is in a first position, and in which current circulates from the actuator to the energy storage device when the switch is in a second position.

26. The system of claim 25, where at least one of the valve actuator subsystems is configured in a buck configuration, in which the actuator is energized via voltage applied from the energy storage device when the switch is in a first position, and in which current circulates from the actuator to the power supply when the switch is in a second position.